INSTRUCTION BOOK

MODEL 1040

A. C. VACUUM TUBE VOLTMETER

FREED TRANSFORMER CO., INC.

INSTRUMENT DIV SION

MP MASTER

MA34241

INSTRUCTION BOOK

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FREED TRANSFORMER CO., INC.

INSTRUMENT DIV SION

FREED TYPE 1040 VACUUM TUBE VOLTMETER

USES:

The type 1040 Vacuum Tube Voltmeter is a high impedance, wide frequency range voltmeter which can be used at audio and supersonic frequencies. It is particularly recommended for:

1. Vibration studies involving very low frequencies.
2. Frequency characteristics and gain measurements on amplifiers.
3. Transmission losses on telephone circuits, filter and carrier systems up to 200,000 cycles.
4. Acoustic measurements, such as, determination of frequency response of microphones and loudspeakers.

Because of the high sensitivity of the instrument, the voltmeter can be advantageously used as a null detector in D.C. bridge measurements. In addition to its use as a voltmeter, the instrument can be used as an ammeter to measure a wide range of currents, by connecting it across suitable resistors.

DESCRIPTION:

The instrument is composed of a high impedance precision five step attenuator, an R.C. coupled multistage amplifier, a balanced rectifier, a balanced D.C. amplifier, and a special meter in which the deflection is proportional to the logarithm of the current through it. A high amount of degeneration is used in both the A.C. and D.C. amplifiers.

FEATURES:

Because of the low input capacity, a high value of input impedance is maintained over the five ranges of the voltmeter. A balanced rectifier, a balanced D.C. amplifier circuit, and a high amount of degeneration throughout the amplifier makes the instrument independent of line voltage variations and changes in tube characteristics. A very important feature of the instrument is the logarithmic voltage scale of the meter. With this type of scale, the percentage accuracy of reading is uniform over the entire scale. Another advantage of the logarithmic scale is that

it provides a uniform decibel scale, which is a very valuable feature in sound and communications measurements. A range adjustment is provided. These two controls serve for all ranges and no re-setting is necessary when switching from one range to another. The time constant of the instrument is adjusted in order to read very low frequencies of 7 to 10 cycles with a minimum vibration of the needle. The circuit of the meter is arranged so that it cannot be burned out by any overload of the instrument. The vacuum tube voltmeter is small, compact, entirely self contained, and A.C. operated.

S P E C I F I C A T I O N S

VOLTAGE RANGES:

.001 volts to 100 volts in five ranges. .01, .1, 1, 10, and 100 volts full scale.

ACCURACY:

2% on full scale of all five ranges, on sinusoidal voltages.

WAVEFORM ERROR:

The instrument is a peak voltmeter calibrated to read RMS values. On distorted waveforms, the percentage deviation of the reading from RMS values may be as large as the percentage of the harmonics present.

FREQUENCY RANGES:

10 to 200,000 cycles. .1 db deviation from 20 cycles to 150,000 cycles; .5 db deviation from 10 cycles to 200,000 cycles.

INPUT IMPEDANCE:

Equivalent to 500,000 ohm resistance in parallel with a 15 mmfd. condenser.

STABILITY:

Effect of variation in line voltage from 105 volts to 125 volts is 1 %. Effect in changes of tubes is less than .5 %.

TEMPERATURE AND HUMIDITY EFFECTS:

Over the normal range of temperature and humidity variation (65 degrees F to 95 degrees F., 0 to 95% relative humidity), the accuracy is substantially unaffected by temperature and humidity conditions.

SCALE:

Logarithmic voltage scale calibrated from 1 to 10, plus a linear decibel scale calibrated from 0 to 20 db.

METER:

4" supressed Zero 1 ma. meter protected against overload.

TUBES:

The following tubes are required and supplied with the instrument.

3 - 6AU6 1 - 12AU7 1 - 6AL5 1 - 6X4 1 - 0A2

POWER SUPPLY:

The instrument is entirely self contained and operates on 105 to 125 volts, 50 to 60 cycles. Total consumption 40 watts.

DIMENSIONS:

4 7/8" High x 5 1/4" Wide x 10" Long.

WEIGHT:

12 lbs.

OPERATING INSTRUCTIONS:

The instrument is ready to operate as received. Plug the instrument into the A.C. power line, (105-125 volts, 50-60 cycles), and turn on the ON-OFF switch. A pilot light is provided to indicate when the power is on. To decrease the hum level, the input terminals marked "G", should always be grounded.

The input circuit is protected from D.C. up to 400 volts. If a D.C. voltage higher than 400 volts is to be applied, an auxiliary protective network should be used. This may consist of a .5 mfd. condenser in series and a 1 megohm resistor in shunt.

MEASUREMENT OF 60 CYCLE VOLTAGES:

When measurements are to be made of voltages derived from the same power source used to operate the voltmeter, a special precaution is recommended for most accurate results. The necessity of this is due to the fact that there is a slight residual hum pick-up from the power transformer, which introduces a slight voltage into the input circuit, causing a slight error. The error is minimum on the upper part of the scale, but may be 2 or 3% at the lower portion of the scale. Where the accuracy of measurement required exceeds 1%, two readings must be taken. Take one reading with the power plug in the normal position, and another reading with the plug reversed. The mean of these two readings will represent the true value.

MEASUREMENT OF VOLTAGE RATIOS:

For measuring voltage ratios, the db scale of the meter should be used. A voltage ratio of 10:1 is equivalent to a 20 db change. To obtain values of voltage ratios 10^N or 10^{-N} times those shown, add or subtract respectively n x 20 db to or from the values on the db scale.

For example:

For voltage ratios of 1000 (10^3) times those shown, add 3 x 20 or 60 db. Conversely for ratios of .001 (10^{-3}) subtract 60 db.

For power ratios divide db scale by 2.
Zero Level = 6 mw. in 600 ohms = 1.9 volts.
Zero DBM = 1 mw. in 600 ohms = .775 volts.

SERVICING:

The servicing of this instrument by the user is not recommended. The only operation that can be performed by the user are, range adjustment and tube renewal.

Note: When replacing fuse or changing tubes, do not remove panel screws. To take the instrument from its cabinet, remove only the four screws holding the feet.

FULL SCALE ADJUSTMENT:

This is a screw driver adjustment accessible through the side of the cabinet. Ordinarily no adjustment should be necessary except when changing tubes. To adjust: Allow the meter to warm up for a period of 10 to 15 minutes. Connect a source of pure sinusoidal 1000 cycles across the input terminals. Set the meter to the 10 volt range. Connect a standard voltmeter in parallel with the meter to be adjusted. Increase the gain of the oscillator until 10 volt output is indicated on the standard voltmeter. Then adjust the full scale adjust of the voltmeter until the needle is exactly on 10.

RANGE ADJUSTMENT:

This is a screw driver adjustment accessible through the side of the cabinet. Its purpose is to bring the 10 on one range to exactly 1 on the next higher range. If adjustment becomes necessary: Allow the meter to warm up for a period of 10 to 15 minutes. Connect a source of pure sinusoidal 1000 cycles across the input terminals.

Adjust the oscillator gain so that the voltmeter reads 10 on any range other than the 100 volt range. Switch to the next higher range. The meter should be adjusted to read exactly 1 by means of the range adjust. Switch back to the lower range and readjust the oscillator gain until the meter again reads 10. Then switch back to the next higher range and check whether the meter reads 1. A readjustment of the range adjust may be necessary if the needle is not exactly on 1.

Caution: This adjustment is not a meter zero adjust. The normal position of the meter needle when the power is off is to the extreme left, against the stop and off scale.

TUBE REPLACEMENT:

If tube replacement becomes necessary, care should be taken to avoid using microphonic tubes or tubes that have high leakage between filament and cathode. To check, short the input terminals and observe meter deflection with range switch on the lowest range. If meter reads, other tubes should be tried. Since any noise in the input tube is amplified in the following stages, it is extremely important that this tube is the least noisy. Interchanging of the amplifier tubes will often be sufficient to decrease the noise level for proper operation.

If the 6AL5 or 12AU7 tubehas to be changed, readjustment of the range setting may be necessary. If this adjustment cannot be properly made, a severe unbalance between the two halves of the 12AU7 or 6AL5 is indicated, and another tube should be tried until the "Range Adjustment" can be properly made.

VACUUM TUBE VOLTMETER 1040

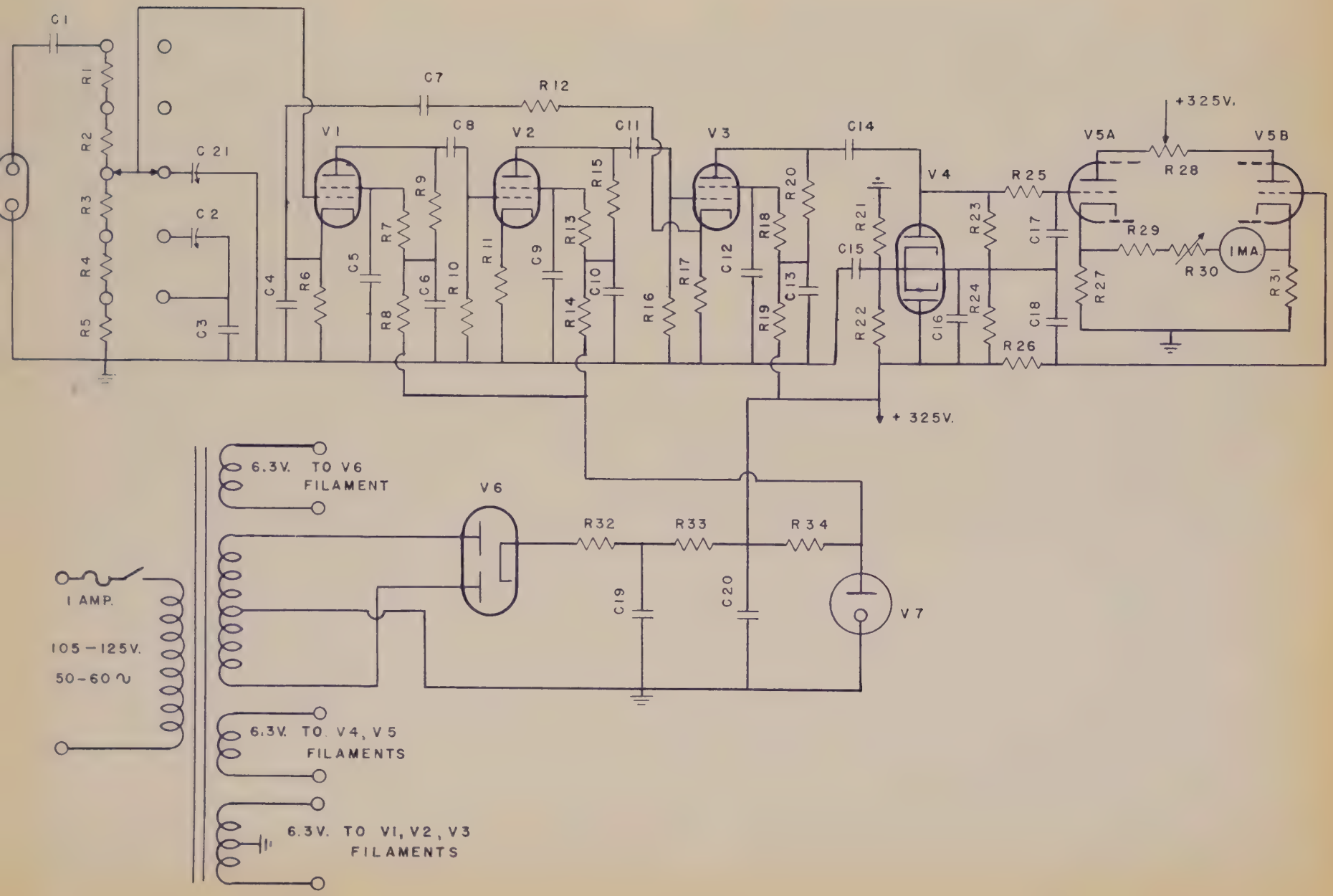

TABLE OF VOLTAGE READINGS

TUBE	PIN 1	PIN 2	PIN 3	PIN 4	PIN 5	PIN 6	PIN 7	PIN 8	PIN 9
V1 6AU6	0	1.1	H	H	85	45	1.1		
V2 6AU6	0	2.5	H	H	85	45	2.5		
V3 6Au6	0	1	H	H	85	50	1		
V4 6AL5	180	120	H	H	180	0	120		
V5 12AU7	320	100	180	H	H	320	100	180	H
V6 6X4	325 AC	0	H	H	0	325 AC	355		
V7 0A2		0			150				

All DC voltages measured to ground with 20,000 ohm/volt meter.
All AC voltages measured toground with 1000 ohm/volt meter.

PARTS LIST

RESISTORS:

R-1	450K	-	1/2 w	- 1%
R-2	45K	-	1/2 w	- 1%
R-3	4.5K	-	1/2 w	- 1%
R-4	450 ohms	-	1/2 w	- 1%
R-5	50 ohms	-	1/2 w	- 1%
R-6	1K	-	1/2 w	- 10%
R-7	220K	-	1/2 w	- 10%
R-8	20K	-	1/2 w	- 10%
R-9	47K	-	1/2 w	- 10%
R-10	470K	-	1/2 w	- 10%
R-11	1K	-	1/2 w	- 10%
R-12	62K	-	1/2 w	- 10%
R-13	220K	-	1/2 w	- 10%
R-14	20K	-	1/2 w	- 10%
R-15	47K	-	1/2 w	- 10%
R-16	470K	-	1/2 w	- 10%
R-17	680 ohms	-	1/2 w	- 10%
R-18	270K	-	1/2 w	- 10%
R-19	120K	-	1 w	- 10%
R-20	47K	-	1/2 w	- 10%
R-21	100K	-	2 w	- 10%
R-22	100K	-	2 w	- 10%
R-23	3 meg.	-	1/2 w	- 1%
R-24	3 meg.	-	1/2 w	- 1%
R-25	3 meg.	-	1/2 w	- 1%
R-26	3 meg.	-	1/2 w	- 1%
R-27	47K	-	2 w	- 10%
R-28	10K	-	2 w	- potentiometer
R-29	22K	-	1/2 w	- 10%
R-30	10K	-	2 w	- potentiometer
R-31	47K	-	2 w	- 10%
R-32	500 ohms	-	5 w	- 5%
R-33	500 ohms	-	5 w	- 5%
R-34	8K	-	10 w	- 5%

CAPACITORS:

C-1	.1 mfd.	- paper	- 200V
C-2	125 mmfd.	- adjusted at factory	
C-3	.01 mfd.	- paper	- 200V
C-4	400-600 mmfd.	- adjusted at factory	
C-5-6-12	15-15-10 mfd.	- electrolytic	- 450V
C-7	.33 mfd.	- paper	- 200V
C-8	.056 mfd.	- paper	- 200V
C-9-10-13	15-15-10 mfd.	- electrolytic	- 450V
C-11	.056 mfd.	- paper	- 200V
C-14	.039 mfd.	- paper	- 400V
C-15	1 mfd.	- oil filled	- 600V
C-16	.01 mfd.	- paper	- 200V
C-17	.056 mfd.	- paper	- 200V
C-18	.056 mfd.	- paper	- 200V
C-19-20	10-10 mfd.	- electrolytic	- 450V
C-21	1600 mmfd.	- adjusted at factory	

TRANSFORMER:

T-1 - Freed # 23791 - Power Transformer

FREED

FREED LOW FREQUENCY "Q" INDICATOR
Type No. 1030

FREED LOW FREQUENCY "Q" INDICATOR Type No. 1030

Uses

The Type 1030 Low Frequency "Q" Indicator measures directly the "Q" factor of coils. The instrument can also be used to measure the inductance of coils, distributed capacity, impedances, and dielectric losses. The "Q" Indicator can be used to study the magnetic properties of iron, such as stability of iron cores in function of applied voltages, and iron losses as a function of the frequency.

Description

The Type 1030 Low Frequency "Q" Indicator consists of five essential elements:

(1) R. C. Low Frequency Oscillator.

(2) Low distortion, high stability, variable impedance amplifier.

(3) High quality variable condenser.

(4) Vacuum tube type voltmeter of a special design, which measures the voltage across the circuit composed of the inductor and variable condenser. This amplifier determines the "multiply-by" factor. A four step rotary switch in the input of the amplifier varies simultaneously the gain of the amplifier and the output impedance, and the voltage of the amplifier, (2), and therefore determines four multiplying factors: .01, .1, 1, 10. A four inch meter in the output of the vacuum tube voltmeter, calibrated in inverse voltage, determines a second multiplying factor, 1 to 5.

(5) High stability, high input impedance vacuum tube type voltmeter, which measures the voltage developed across the variable condenser directly in terms of "Q", or in terms of voltage. A two step attenuator in the input of the vacuum tube voltmeter determines either the 5 volt or 50 volt sensitivity of the amplifier and establishes two multiplying factors, 1 or 10.

The procedure of measuring the "Q" consists of connecting the inductor in series with the variable condenser, setting the oscillator at the desired frequency, adjusting the variable condenser until a maximum is read on the voltmeter calibrated directly in terms of "Q". When this maximum is obtained the "Q" of the coil is given directly as the product of the "Q" voltmeter indication and the "multiply-by" factors. The magnitude of the "multiply-by" factor varies from .01 to 500, while the "Q" varies from either 0 to 50, or 0 to 500, which corresponds to 5 volts or 50 volts across the coil.

Features

The main and essential feature of the instrument is that the "Q" factor is read directly without any complicated computations. The possibility of measuring "Q" through the whole audio and supersonic frequency range is provided. The setting up and the measuring of the "Q" of coils is practically instantaneous. The instrument is unaffected by line voltage variations, is entirely self-contained and A. C. operated. Both meters ("multiply-by" and "Q") are protected against overloads and cannot be burned out. The effective frequency range for "Q" measurements is 50 to 50,000 cycles. Due to the fact that the R. C. Oscillator frequency range is from 20 to 200,000 cycles, comparative "Q" Measurements can be made below 50 cycles and above 50,000 cycles. Since the "Q" factor appears as a relative quantity, i.e., a ratio of two voltages, the tracking of the two meters is such that a reasonably good accuracy of "Q" factors is obtained for frequencies above 50,000 cycles. The terminals of the variable decade condensers are available directly on the front panel of the instrument and can therefore be used as a high quality precision variable condenser. The R. C. Oscillator and variable impedance amplifier can be used as a separate low frequency generator with a maximum output power of two watts in a 50 ohm load. The "Q" scale is calibrated from 0 to 50. A high accuracy of measurement is obtained, since for any position of the multipliers, a total of "Q" variation from 0 to 50 is read on a 3 inch scale. "Q" factors of coils can be measured with up to 50 volts across the coil, and therefore makes it possible to determine the stability and the variations of the "Q" factor of coils in function of the applied voltage. The voltage fed into the series circuit is variable from 10 volts to .01 volt.

Specifications

RANGE OF "Q" MEASUREMENTS: The range of "Q" factors is from .5 to 500 over the frequency range from 50 to 50,000 cycles. The accuracy of "Q" measurement is approximately 5% for frequencies up to 50,000 cycles.

OSCILLATOR FREQUENCY RANGE: Continuously variable from 20 to 200,000 cycles in four ranges.

FREQUENCY ACCURACY: 1% under normal temperature conditions. The frequency stability is better than 2% over a long period of time.

VARIABLE IMPEDANCE AMPLIFIER: Wide band amplifier with less than 10% voltage variation from 50 to 50,000 cycles.

WAVE FORM: Under normal operating conditions the harmonic distortion is 1% at 50 cycles. The distortion decreases when the frequency increases.

OUTPUT IMPEDANCE AND VOLTAGE: Four output impedances are available.

(a) 10 ohms impedance— 10 V Output Voltage
(b) 1 ohm impedance— 1 V Output Voltage
(c) .2 ohm impedance— .1 V Output Voltage
(d) .1 ohm impedance—.01 V Output Voltage

Those Impedances are measured at 50,000 cy.

VARIABLE CONDENSER: The variable condenser consists of a 10 x 1 MF high quality oil filled paper condenser decade, a 10 x .1 MF mica condenser decade, a 10 x .01 MF mica condenser decade, a 10 x .001 mica condenser decade, and a 1000 micromicrofarad air variable condenser.

ACCURACY OF ADJUSTMENT: The 10 x 1 MF decade is adjusted within .5% of the nominal capacitance value. All mica condensers are adjusted to within 1% or 10 micromicrofarads, whichever is larger. The value of the total variable capacitors at its terminals is determined by the effective zero capacitance of the whole unit which is made up of the true zero capacitance and the mutual capacitance between units. The value of the effective zero capacitance is 100 micromicrofarads.

TEMPERATURE COEFFICIENT: The temperature coefficient of the 10 x 1 MF decade is less than 1% for a temperature variation from minus 50°C to plus 50°C. The temperature coefficient of the mica decades is less than plus .01% per degree centigrade between 10 degrees and 50 degrees centigrade.

FREQUENCY CHARACTERISTICS: All condensers are adjusted to their nominal value 1000 cycles and at 25 degrees centigrade. The effective terminal capacitance of the mica decade and the air variable condenser is essentially constant up to one megacycle. The 10 x 1 MF paper decade shows a slight increase in capacity at 50 cycles.

POWER FACTOR: The losses in the switches and mountings are kept very low by the use of special low loss, impregnated ceramic switch wafers. The power factor of the paper decade condenser is .06% per 1 microfarad at 1000 cycles. The power factor of mica decades is of the order of .01% at 1000 cycles. At 100,000 cycles the power factor decreases to about .005%. The losses in the variable air condenser are negligible at the frequencies used.

MAXIMUM VOLTAGE: The maximum peak voltage the condensers will safely withstand is 500 volts for all but the first decade which will withstand 200 volts. As the frequency of the applied voltage increases, the losses in the 10 x 1 MF decade, and 10 x .1 MF decade increase. It is therefore recommended that the 10 x 1 MF decade be used up to 1000 cycles only. Similarly the 10 x .1 MF decade should be used up to 5000 cycles only.

THE "MULTIPLY-BY" VACUUM TUBE VOLTMETER: Gain 40db. Frequency response .1db. from 50 to 50,000 cycles. This Amplifier determines four multiplying factors: .01, .1, 1, and 10. A four inch meter in the output of the amplifier, calibrated in inverse voltage, determines an additional multiplying factor from 1 to 5. The magnitude of the total multiplying factor is from .01 to 50. The Vacuum Tube Voltmeter is unaffected by line voltage variations.

"Q" READING VACUUM TUBE VOLTMETER: Input impedance 100 megohms. Frequency response .1db. from 50 to 50,000 cycles. Total sensitivity is 5 volts or 50 volts selected by a rotary switch in the input of the amplifier. This two position attenuator determines the multiplying factor of 1 or 10. A four inch meter in the output of the amplifier is calibrated in voltage or "Q". The voltage calibration is from 0 to 5. The "Q" calibration is from 0 to 50. The Vacuum Tube Voltmeter is unaffected by line voltage variations.

TEMPERATURE AND HUMIDITY EFFECTS: Over the normal range of temperature and humidity variation (65 degrees F. to 95 degrees F., 0 to 95% relative humidity the accuracy is substantially unaffected by temperature and humidity conditions. An excessive increase in temperature may necessitate the zero and full scale readjustment of the meter.

POWER SUPPLY: The instrument is entirely self-contained and A.C. operated. Total consumption 200 watts.

TUBES: The following tubes are required and are supplied with the instrument:

2—Type 6H6 Metal	4—Type 6SH7 Metal
2—Type 6L6 GT	2—Type 5V4 G
2—Type 6J5 Metal	1—Type VR150
3—Type 6SN7 GT	1—6 Watt 115 Volt Mazda
3—Type 6SJ7 Metal	
1—Type 6V6 GT	1—6-8 Volt Pilot Light

	W.	D.	H.
Dimension	19½"	14½"	23"
Weight	120 lbs.		

FREED TRANSFORMER COMPANY, Inc.

Instruments Division

1718-36 WEIRFIELD ST., BROOKLYN (RIDGEWOOD) 27, N. Y.

Printed in U. S. A.

FREED

Vacuum Tube Type

VOLTMETER

TYPE No. 1040

Uses: The type 1040 Vacuum Tube Voltmeter is a high impedance wide frequency range voltmeter which can be used at audio and supersonic frequencies. It is particularly recommended for (1) vibration studies involving very low frequencies, (2) frequency characteristics and gain measurements on amplifiers, (3) transmission losses on telephone circuits: filter and carrier systems up to 200,000 cycles, and (4) acoustic measurements, such as, determination of frequency response of microphones and loudspeakers. Because of the high sensitivity of the instrument, the voltmeter can be advantageously used as a null detector in D.C. bridge measurements. In addition to its use as a voltmeter, the instrument can be used as an ammeter to measure a wide range of currents by connecting it across suitable resistors.

Description

The instrument is composed of a high impedance precision five step attenuator, an R.C. coupled multistage amplifier, a balanced rectifier, a balanced D.C. amplifier, and a special meter in which the deflection is proportional to the logarithm of the current through it. A high amount of degeneration is used in both the A.C. and D.C. amplifiers. The switching from one voltage range to another is accomplished in the input circuit.

Features

Because of the low input capacity, a high value of input impedance is maintained over the five ranges of the voltmeter. A balanced rectifier, a balanced D.C. amplifier circuit, and a high amount of degeneration throughout the amplifier makes it independent of line voltage variations and changes in tube characteristics. A very important feature of the instrument is the logarithmic voltage scale of the meter. With this type of scale, the percentage accuracy of reading is uniform over the entire scale. Another advantage of the logarithmic scale is that it provides a uniform decibel scale which is a very valuable feature in sound and communication measurements. A zero adjustment and full scale adjustment is provided. These two controls serve for all ranges and no re-setting is necessary when switching from one range to another. The time constant of the instrument is adjusted in order to read very low frequencies of 7 to 10 cycles without any vibration of the needle. The circuit of the meter is arranged so that it can not be burned out by any overload of the instrument. The vacuum tube voltmeter is small, compact, entirely self-contained, and A.C. operated.

Specifications

VOLTAGE RANGES: .001 volts to 100 volts in five ranges (.01, .1, 1, 10, and 100 volts full scale).

ACCURACY: 2% on full scale on all five ranges, on sinusoidal voltages.

WAVEFORM ERROR: The instrument is a peak voltmeter calibrated to read RMS values. On distorted waveforms, the percentage deviation of the reading from RMS values may be as large as the percentage of the harmonics present.

FREQUENCY RANGES: 10 to 200,000 cycles, .1 db. variation from 20 cycles to 150,000 cycles; .50 db. variation from 10 cycles to 200,000 cycles.

INPUT IMPEDANCE: Equivalent to 500,000 ohm resistance in parallel with a 15 MMF. condenser.

STABILITY: Effect of variation in line voltage from 100 volts to 125 volts is 1%. Effect in changes of tubes is less than .5%.

TEMPERATURE AND HUMIDITY EFFECTS: Over the normal range of temperature and humidity variation (65 degrees F. to 95 degrees F., 0 to 95% relative humidity), the accuracy is substantially unaffected by temperature and humidity conditions.

SCALE: Logarithmic voltage scale calibrated from 1 to 10 plus a linear decibel scale calibrated from 0 db. to 20 db.

METER: 4" suppressed zero 1 MA. meter protected against overloads.

TUBES: The following tubes are required and supplied with the instrument:

3—6AU6	1—6X4
2—6C4	1—0A2
1—6AL5	1—6-8 Volt Pilot Lamp

POWER SUPPLY: The instrument is entirely self-contained and operates on 100-125 volts, 50-60 cycles. Total consumption, 40 Watts.

DIMENSIONS: 4⅞" High 5⅝" Wide 8⅞" Long

WEIGHT: 12 pounds.

PRICE: **$195.00**—F.O.B. New York, N. Y.

FREED TRANSFORMER COMPANY, Inc.

Instruments Division

1718-36 WEIRFIELD ST., BROOKLYN (RIDGEWOOD) 27, N. Y.

Printed in U. S. A.

FREED

Null Detector AND *Vacuum Tube* VOLTMETER TYPE No. 1210

Uses: The Type 1210 Null Detector and Vacuum Tube Voltmeter is primarily designed for bridge measurements. The Null Detector indicates the balance of the bridge, and the Vacuum Tube Voltmeter indicates the voltage across the unknown two terminal or four terminal network. The three selective circuits provide means for sharply tuning the instrument to audio frequencies commonly used for measurements. The Vacuum Tube Voltmeter can be used as a general purpose audio Vacuum Tube Voltmeter.

Description:

The Type 1210 Null Detector and Vacuum Tube Voltmeter is a combination of the Model 1140 Null Detector Amplifier, and a modified model 1060 high input impedance Vacuum Tube Voltmeter. Both instruments are independent and feed two separate 4" meters.

The Null Detector consists of a high gain linear amplifier with a 30 Db input attenuator in addition to the variable gain control. A four inch panel meter provides visual null indications. The instrument can be used either as a linear amplifier or selective amplifier. The response of the meter circuit is approximately logarithmic over a 40 Db voltage range. Resonant circuits tuned to 60 cycles – 400 cycles and 1000 cycles limit the amplifier transmission characteristics to the three audio frequencies commonly used for bridge measurements. The Vacuum Tube Voltmeter is composed of an RC Coupled Multistage amplifier, a bridge rectifier and a four inch meter calibrated both in volts (0-150) and in decibels (−6 to + 3 DB). A high amount of degeneration is used in the AC amplifier.

Connections to both the Null Detector and the Vacuum Tube Voltmeter are made by using conventional binding posts. The input circuits are isolated from D.C. by blocking Condensers. All functional switching for both the Null Detector and Vacuum Tube Voltmeter are made by two five position pushbutton switches.

Features:

The Null Detector is designed for maximum usefulness in the measurements laboratory. The instrument is self contained and AC operated. The three selective circuits are built in the instrument and thus without requiring any external accessories, provide a simple and effective means for restricting the response of the Null Detector to a narrow range resulting in the elimination of harmonics and noise outside the frequency range.

All controls are accessible from the front panel. All switching is accomplished by push buttons.

The Vacuum Tube Voltmeter is particularly adapted for measurements of the voltage across the unknown network connected in the bridge circuit. Due to the very high Input resistance (50 megohm) and low capacity (15 mmf) the balance of the bridge is unaffected by the Vacuum Tube Voltmeter, permanently connected across one of its arms. The instrument can also be used as a general purpose high input impedance Voltmeter particularly recommended for selectivity and voltage measurements across high Q resonant circuits. The instrument is self contained and AC operated. All controls are accessible from the front panel. A full scale calibration control is provided. All switching is accomplished by push buttons.

The meters of both instruments are protected against over loads.

Specifications:

NULL DETECTOR

INPUT IMPEDANCE: — 1 megohm in parallel with 25 mmf.

FREQUENCY RESPONSE: 2 Db from 20 to 20,000 cycles — 5 Db at 50,000 cycles.

NULL DETECTOR SENSITIVITY: At 1000 cycles, 100 microvolts will give a 15% meter deflection.

SELECTIVE AMPLIFIER: 23 Db second harmonic attenuation @ 60 cycles, 400 cycles and 1000 cycles.

VACUUM TUBE VOLTMETER

VOLTAGE RANGES: .01 volts to 100 volts in four ranges — (.1 — 1 — 10 — 100 volts at ¾ of scale.)

ACCURACY: 2% on full scale of all four ranges.

WAVEFORM ERROR: The instrument is a full wave average meter and is free of turnover effects. For small amounts of distortion the accuracy of the instrument is independent of the waveform.

FREQUENCY RANGE: 20 cycles to 20,000 cycles (1 Db).

INPUT IMPEDANCE: Equivalent to 50 megohms resistance in parallel with a 15 mmf condenser.

STABILITY: Effect of variation in line voltage from 100 volts to 125 volts is 2%. Effect in changes of tubes is less than .5%.

METER SCALE: Voltage scale calibrated from 0 to 150. Decibel scale calibrated from — 6 Db to + 3 Db.

TEMPERATURE AND HUMIDITY EFFECTS: The reading of the Voltmeter is unaffected by temperature and humidity variations of 65° F. to 95° F. and 0 to 90%.

TUBES: The Null Detector and Vacuum Tube Voltmeter requires the following tubes, all supplied with the instrument:

4 — 6J5 2 — 6SH7 1 — 6SN7 1 — 6C6
1 — 6SK7 1 — 6X5 2 — VR - 105
1 — 6 - 8 volts pilot light 1 — 2 Amp fuse

DIMENSIONS: Rack Mounting 19 x 9 x 11½".

NET WEIGHT: 25 Lbs.

PRICE: $325.00 Net F.O.B. Brooklyn, N. Y.

FREED TRANSFORMER COMPANY, Inc.
Instruments Division
1718 WEIRFIELD ST., BROOKLYN (RIDGEWOOD) 27, N. Y.

Printed in U. S. A.

FREED

D. C. Supply

TYPE No. 1170

Uses: The Type 1170 Power Supply is intended to be used as a dependable source of direct current for the Incremental Inductance Bridge Type No. 1110. The supply can also be used as a general laboratory substitute for a high voltage storage battery.

Description:

The Type 1170 D.C. supply consists of an electronically regulated high voltage supply. Four independent control circuits provide four current ranges, namely 5 milliamperes, 25 milliamperes, 100 milliamperes and 500 milliamperes. The output current is indicated by a multirange 4" meter.

Features:

Separate controls for continuous variation of current are provided for the four different ranges. Extremely low hum and a constant output voltage independent of line and load variations, and an extremely low internal resistance makes it possible to use the regulated supply instead of a storage battery. All controls are accessible from the front panel. The four current ranges of the meter are independently fused.

Specifications:

CURRENT RANGES: Four current ranges — 0-5 MA, 0-25 MA, 100 MA and 500 milliamperes.

VOLTAGE RANGES: The maximum no load voltages corresponding to the four current ranges are the following: 500 MA – 270 volts, 100 MA – 270 volts, 25 MA – 55 volts, 5 MA – 25 volts. On both 500 MA and 100 MA range with the control set to zero, the output voltage is independent of the load.

VOLTAGE REGULATION: The unit operates from a 115 volts, 50-60 cycle line. For a line variation of plus or minus 10%, the output voltage shall not vary more than ± 1½%.

POWER CONSUMPTION: Under 500 MA full load the power consumption is 360 watts. Under no load conditions the consumption is 150 watts.

HUM LEVEL: On the 270 volt, 500 milliampere range the hum level under full load condition is 6 millivolts which corresponds to – 92 Db.

TUBES: The instrument uses and is supplied with the following tubes and accessories:

3 — 5V4 3 — 6AS7
1 — OA2 1 — (6-8) volt pilot lamp
1 — .8 amp fuse, 1 — .2 amp fuse, 1 — 1/16 amp fuse and 1 — .01 amp fuse

MOUNTING: The instrument is supplied for mounting on a 19 inch relay rack or for cabinet mounting.

DIMENSIONS:

	W	D	H
Rack:	19" x	13 3/16" x	12¼"
Cabinet:	21½" x	15" x	14"

NET WEIGHT: Rack — 68 Lbs.; Cabinet — 89 Lbs.

PRICE: $275.00 Net, F. O. B., Brooklyn, N. Y.

FREED TRANSFORMER COMPANY, Inc.
Instruments Division
1718 WEIRFIELD ST., BROOKLYN (RIDGEWOOD) 27, N. Y.

Printed in U. S. A.

TYPE 1110-A

Incremental

INDUCTANCE BRIDGE

Uses: The Incremental Inductance Bridge is designed for measuring the inductance of Iron Core components at any frequency up to 10,000 cycles. Inductors can be measured with a superimposed direct current, therefore, the bridge will measure the incremental inductance of coils. The bridge can be used for determination of storage factor, "Q", either at a given frequency in function of the applied voltage or at a given voltage in function of the applied frequency.

The bridge can be used by the manufacturers of iron core components, such as filter chokes, high Q coils, and iron core audio and supersonic frequency components. Due to its very wide inductance range the instrument can be used as a general purpose laboratory inductance bridge.

Description:

The bridge is a conventional Owen Bridge and measures inductors in terms of a standard condenser and resistor. Special circuit arrangements make possible to superimpose a direct current through the unknown inductor and one arm of the bridge. A shielded built-in Isolation Transformer is capable of transferring high A.C. power from an A.C. line or audio frequency source to the arms of the bridge. All controls are available from the front panel. The switching from one range to another is accomplished by a five position push button switch. The Inductor value is read directly on a four dial decade. The effective resistance of the inductance is measured in terms of its conductance and is read directly in mhos on a four dial decade.

Features:

The inductance and conductance are read directly on four dial decades. The direct reading feature avoids lengthy computation of inductance in terms of standard resistors and condensers. A very high inductance range, wide frequency range, and means of superimposing high values of direct current are the outstanding features of the bridge.

The process of balancing the bridge is easy and rapidly convergent. The conditions of balance of the resistive and reactive component are independent. The balance does not depend on frequency of wave form. The value of inductance as read from dial settings or the bridge is nominally independent of frequency and also independent of the storage factor Q of the inductor.

Specifications:

INDUCTANCE RANGES: One millihenry to one thousand henries in five ranges. Inductance values are read directly from a four dial decade and a multiplier switch. The last range may be extended to 10,000 henries through the use of an external resistance.

CONDUCTANCE RANGES: One micromho to one mho in five ranges, read directly from a four dial decade and a multiplier switch. This conductance represents the reciprocal of the A.C. resistance of the coil.

"Q" RANGE: "Q" is measured as the product of Inductance (L) and Conductance (G). The range of "Q" measured on this bridge is 15 to 100. Measurement of inductance is independent of the values of "Q".

ACCURACY: 1% through the frequency range from 60-1000 cycles, 2% for frequencies from 1000 to 10,000 cycles. This accuracy is decreased for extreme positions of the multiplier. Conductance measurements 5% from 60-1000 cycles.

FREQUENCY RANGE: The bridge is calibrated and adjusted at both 60 and 1000 cycles, but can be used at any frequency up to 10,000 cycles. Errors resulting from stray capacity increase with frequency. Coils having a high inductance should be measured at a low frequency to avoid resonance effect.

RANGE OF SUPERIMPOSED D.C.

On multiplier switch position L X 100, the D.C. is limited to 10 ma.
On the position L X 10, the D.C. is limited to 250 ma.
On all other positions, the D.C. can be one ampere maximum.

TEMPERATURE AND HUMIDITY EFFECTS: The readings of the bridge are unaffected by temperature and humidity variations of 65° F. to 95° F. and 0 to 90%.

MOUNTING: Instrument is supplied for mounting on a 19-inch relay rack or in wood cabinet.

DIMENSIONS:

	W	D	H
Rack:	19	8	14"
Cabinet:	21	8	14⅝"

NET WEIGHT: Rack — 37 Lbs.; Cabinet — 48 Lbs.

Printed in U. S. A.

FREED TRANSFORMER COMPANY, Inc.

Instruments Division

1718-36 WEIRFIELD ST., BROOKLYN (RIDGEWOOD) 27, N. Y.

FREED No. 1020 MEGOHMMETER

Uses

The measurement of leakage resistance of insulating materials, condensers, cables, motor and transformer windings.

Description

The instrument is a precision balanced electronic ohmmeter.

The high voltage potential necessary for insulation measurements is included in the instrument. An exceptionally wide range of resistances can be measured on the six overlapping ranges. A zero adjustment is provided for setting all the six ranges in a single operation. The resistance is read directly on a 4″ meter scale. The meter is protected against overloads.

A relay operated from the front panel disconnects the high voltage from the binding posts and this eliminates all danger of shock due to exposed high voltage potential.

In the stand by position, the relay connects a high resistance between the high voltage binding posts and the chassis (ground) thus eliminating the danger of shock when measuring the leakage resistance of condensers.

The instrument is self contained, completely AC operated and has electronically regulated high voltage supplies.

Specifications

Range: 1 megohm to 1,000,000 megohms in six overlapping ranges.

Accuracy: Plus or minus 3% on the first four ranges; plus or minus 8% on the last two ranges.

Temperature and Humidity Effect: The accuracy of the instrument is substantially independent of temperature and relative humidity variations within the normal range.

Stability: A plus or minus 10% variation in the line voltage causes less than a 1% variation in the meter reading.

Voltage on the Unknown: The voltage applied to the unknown is 500 volts and is independent (less than 1%) of the values of the unknown.

Tubes: The following tubes are required and supplied with the instrument:

2—6C6	1—VR75
2—6SH7	1—1-V
1—VR105	1—6X5

Power Supply: 105 to 125 volts AC, 50 or 60 cycles. Power Consumption—32 watts.

Cabinet: Portable and of all metal construction.

Dimensions: 9½″ x 10½″ x 8″.

Net Weight: 21 lbs.

PRICE **$237.00** F.O.B. New York.

Printed in U. S. A.

FREED TRANSFORMER COMPANY, Inc.

Instruments Division

1718-36 WEIRFIELD ST., BROOKLYN (RIDGEWOOD) 27, N. Y.

FREED COMPARISON and LIMIT BRIDGE
Type No. 1010

Uses

This instrument is a comparison and limit bridge for use in both laboratory and production testing of resistors, condensers and inductors. The manufacturer of these components can use it for production tests, the user for incoming inspection and acceptance tests. The instrument is particularly useful for laboratory work (bridge or filters) where very accurate components are required.

Features

For precision and production testing, the bridge has many advantages. Power line operation and the visual indicator make the instrument completely self-contained. It can be used in noisy locations. Its small size and light weight permit the instrument to be moved easily and to be set up wherever necessary.

Description

The instrument is composed of an oscillator, a bridge and an amplifier. The oscillator feeds the frequencies into a bridge consisting of 2 fixed resistors, the unknown impedance and the standard. A variable resistor connected between the 2 fixed resistors makes it possible to read the percentage difference between the unknown and the standard, on a specially calibrated dial. A high gain amplifier indicates the balance of the bridge. The general method of testing is the comparison of an unknown component with a standard component of the same type. Accurate percentage measurements are obtained by the use of precision components in the arms of the bridge. The use of high gain amplifier and adequate internal shielding assures a very sharp and distinct balance.

A visual null indicator, consisting of a 500 microampere-meter and used in connection with the high gain amplifier makes it possible to use the No. 1010 Bridge as a precision limit bridge in production testing.

Specifications

1—FREQUENCY: Three frequencies are available: 50 to 60 cycles, 1000 cycles, and 10,000 cycles.

The 50 or 60 cycles are taken from the line.

The 1000 and 10,000 cycles are generated by an oscillator and are accurate to within 10%.

2—RANGE: Two comparison ranges are provided: 10% and 20%. They are selected by a rotary switch. In the 10% position the percentage is read directly on a calibrated dial. In the 20% position the reading of the dial is multiplied by two.

3—RESISTOR MEASUREMENTS: Resistors from 10 ohms up to 1 megohms are measured by the comparison method at 60 cycles. Resistors of greater value than 1 megohm can be measured by using the instrument as a limit bridge.

4—CONDENSER MEASUREMENTS: Condensers from 500 micromicrofarads up to 10 microfarads are measured by the comparison method at 1000 cycles. Condensers above 10 microfarads are measured by the comparison method at 60 cycles.

Small condensers 500 micromicrofarads to 25 micromicrofarads are measured at 1000 cycles, with the instrument used as a limit bridge.

5—INDUCTOR MEASUREMENTS: Inductors can be measured at 60 cycles, 1000 cycles or 10,000 cycles depending upon their values.

Ranges:

L—100Hy to 1 Hy	F— 60 cycles
L— 1Hy to .01 Hy	F— 1,000 cycles
L—.01Hy to .1mHy	F—10,000 cycles

6—ACCURACY: On the 10% position the components can be adjusted to within an accuracy of .5%.

Components to be adjusted to ± 10% accuracy should be tested on the 20% position.

7—VOLTAGE APPLIED TO THE UNKNOWN: The voltage impressed across the unknown terminals varies with the absolute value of the unknown. The maximum voltage is 15 volts. The minimum voltage is .5 volts.

8—POWER SUPPLY: 105 to 125 volts, 50-60 cycles. The power consumption is 40 watts.

9—CONTROLS:

(a) Oscillator Controls—Frequency selector switch and output level control.

(b) Bridge Controls—Main percentage dial. "C balance," Range selector, 3 position switch (balance, 10% and 20%).

(c) Null Indicator Controls—5 step attenuator for the adjustment of the gain of the amplifier. Screw head adjustment for the zero of the vacuum tube volt meter.

10—ACCESSORIES SUPPLIED: Spare fuses and Pilot lamps.

11—VACUUM TUBES: All are supplied with the instrument.
1 – 6X5 1 – 6SL7 1 – 6J5 1 – 6V6 2 – 6SJ7

12—PORTABLE: Carrying cabinet of all metal construction.

13—NET WEIGHT: 15½ lbs.

14—DIMENSIONS: 10½" x 8¾" x 12".

PRICE **$150.00** F.O.B. New York.

Printed in U. S. A.

FREED TRANSFORMER COMPANY, Inc.
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1718-36 WEIRFIELD ST., BROOKLYN (RIDGEWOOD) 27, N. Y.

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